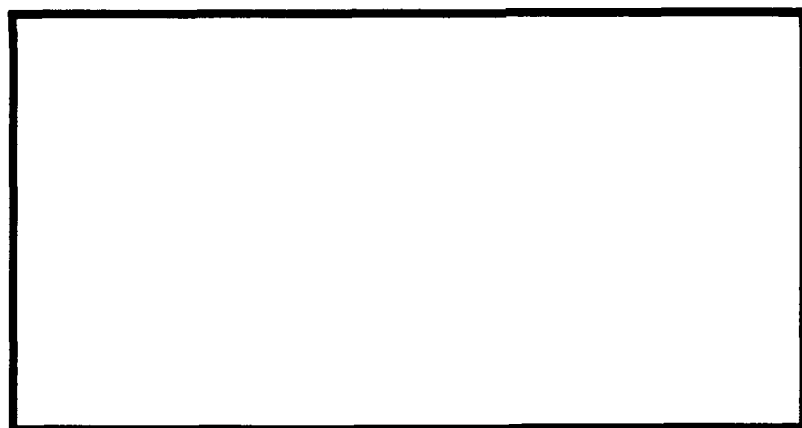


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CHANGES IN U.S.-INTERNATIONAL  
ARMS TRADE PRACTICES

THESIS

Rustam S. Karmali  
Captain, USAF

AFIT/GCA/LSY/91S-4

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ARMS TRADE PRACTICES

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Cost Analysis

Rustam S. Karmali

Captain, USAF

September 1991

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Abstract

This study sought to highlight the evolution of certain trade practices in U.S.-international arms trade. Limited to the eighties, the study divided the decade into two halves: 1980-84 and 1985-89. For each of the nine trade practices considered, period profiles for the two halves were developed and subsequently compared. The population consisted of the eighteen largest (by dollar value) sales of the decade. They included Air Force, Navy and Army systems. Some programs were FMS programs while others were cooperative or direct commercial sales.

The following results were noted: The second half of the decade witnessed some diversification in the types of weapon systems sold. The customer base remained unchanged at two-thirds of sales being made to third world countries. The second half evidenced an increase in direct commercial sales activity. Consequently, more non-LOA documents were used to implement the sales. The number of times offsets occurred in each period stayed the same. Furthermore, the average level of offsets remained remarkably constant. However, the direct to indirect offset ratio rose in the second half. Companies and countries became more creative in implementing offsets. Economic ramifications of weapon sales gained importance in the second half.

CHANGES IN U.S.-INTERNATIONAL  
ARMS TRADE PRACTICES

I. Introduction

Driven by resource limitations and a commitment to a strong conventional defense, the U.S. and its allies have pursued armament cooperation as an effective means of correcting key conventional force deficiencies. To increase the affordability of planned and ongoing U.S. research, development, and production programs, we are augmenting steadily our investments in cooperative efforts in which development costs and resources are shared with our allies. As a result, we project that our investment in cooperative programs will increase from the current 3% of research, development, and test and evaluation (RDT&E) resources to 25% by the year 2000. (Frank C. Carlucci, Secretary of Defense, in the Annual Report to the Congress for Fiscal Year 1989:99)

This sentiment is echoed across the administration.

The Deputy Secretary of Commerce said in testimony prepared for delivery before the Senate Committee on Banking, Housing, and Urban Affairs that "...the dramatic globalization of technology is perhaps the single most dominant industrial development over the past ten years" (49-4). The Congressional Office of Technology Assessment (OTA) concurs in a May 1989 report entitled Technology and the American Economic Transition: Choice for the Future by saying that collaboration in research is gaining importance since

...most nations and private organizations find the costs of sponsoring a "world class" research

program prohibitive, they have concluded that for all its problems, banding together is the only way to go.

These comments herald the added importance U.S.-international arms trade will take on in the future. It will build upon unprecedented levels of arms trade activity experienced in 1987 and 1988 as indicated below:

- Total arms exports for 1988 were \$ 14,300 M compared to \$ 9,055 M in 1980 (up 58%).
- Compared to total exports, arms exports accounted for 4.4% in 1988, up from 2.8% in 1980.
- Compared to domestic defense outlays, arms exports remained at roughly 4.5% between 1988 and 1980 (2:7).

While these trends are not universally welcomed, it is noteworthy that the Department of Defense is beginning to take on a significant role in U.S.-international trade. In the words of Robert McCormack, Deputy Undersecretary of Defense for Industrial and International Programs

..the need for international cooperation is driven by economics as well as the strengthening of relations with the allies. It is sort of a two-way street there. The more people look at the economics of it, the more apparent it is that we need cooperation. (29:47)

## Chapter Overview

Having briefly presented the views of some members of the administration on where the U.S. needs to go with future arms trade and some statistics on where it has been, this chapter seeks to provide the general issue, objectives of the research, investigative questions, and justification for the efforts. The chapter concludes with the sequence of presentation for the rest of the study.

## General Issue

The concepts of trade and competitiveness are closely related. One definition of a country's competitiveness is "a country's capability to create, produce, distribute, and/or service products in international trade while earning rising returns on its resources" (60:3). This is an important relationship because much research has been done on U.S. competitiveness which serves to enhance this study.

In 1985, the President's Commission on Industrial Competitiveness submitted an evaluation of the nation's ability to compete in world markets. Amongst its findings, it purported that:

U.S. trade and international economic policies have not yet assumed an equal stature with other U.S. policies. In part, this is symptomatic of fragmented and duplicative U.S. trade and investment policy mechanisms. Decisions are split between at least twenty-five executive branch agencies and nineteen Congressional Subcommittees. Many governmental agencies--State, Justice, Treasury, and Defense among them--make policies that strongly influence our international trade

position. Often they fail to consider the ramifications of their decisions on our ability to compete in world markets. (54:38)

Separately, the Harvard Business School sponsored sixteen colloquium meetings, the presentations of which appear under the title "U.S. Competitiveness in the World Economy". In its findings, it reported that

Trade and adjustment policy is made in countless places throughout Washington: Defense, State, Commerce, Treasury, Agriculture, Labor, The Senate, and the House. The Office of the U.S. Trade Representative (USTR) is theoretically designed to coordinate all these matters, but it can only do this with a strong presidential endorsement, which has been lacking in recent years. (35:497)

The examination of the effects of such fragmentation is a research study unto itself and is beyond the scope of this one. Instead, this study examines the extent to which the Department of Defense engages in international trade. This study will seek to compare and contrast international arms trade practices between two periods: the first half of the decade (1980-1984) and the second half (1985-1989).

Besides being the middle of the decade, 1985 is considered a pivotal year for the following reasons:

- There existed heightened awareness of America's diminishing competitiveness in the world marketplace partly precipitated by the findings of the President's Commission on Industrial Competitiveness and the findings of the Harvard Business School Study mentioned above.

- Congressional legislation was enacted that recognized the need to engage in international armament cooperation. Known as the Nunn Amendment, this legislation paved the way for U.S.-NATO international R & D agreements by providing up to 200 million dollars annually.

Twelve agreements were signed for research and development projects while many others are at various stages in the process toward agreement.

### Objectives of the Research

This study attempts to compare and contrast two halves of the last decade in order to highlight changes in practices within the U.S.-international arms trade arena. An example of a change in trade practice might be that the U.S. authorized more direct commercial sales arrangements in major weapon system sales in the second half of the decade than it did in the first half. To help guide the research effort, the following investigative questions were developed.

### Investigative Questions (IQs)

IQ 1. Was there a difference in the types of weapon systems sold?

IQ 2. Was there a difference in the customer base?

IQ 3. Was there a difference in the purchasing arrangements the U.S. permitted its customers?

IQ 4. Was there a difference in the contractual vehicles used to execute the sales?

A discussion of U.S.- international arms trade practices would be grossly incomplete without an examination of offset practices. The following investigative questions address offsets:

IQ 5. Regarding offsets, was there a difference in the frequency of their use?

IQ 6. In those instances where offsets were involved, was there a difference in the level of offsets granted? IQ 7. Where offsets were granted, was there a difference in the direct to indirect offset ratio?

IQ 8. In satisfying their offset obligations, were the types of undertakings different?

The final investigative question was more ambitious than the others in that it was wider in scope. It sought the answer to

IQ 9. Was there a difference in the issues that surrounded the sales? As an example, were national debates about individual sales concerned with economic or national security issues and did those issues change when comparing the two halves of the decade?

The answers to these questions formed the basis for the narrative that describes each sale.

For each investigative question, observations from sales of each period were synthesized into period profiles. Finally, period profiles were compared to highlight similarities and contrasted to highlight differences. To help put the study in a broader context, two additional questions have been answered:

1) What have been the changes in U.S.-international trade? This is the issue of U.S. competitiveness (as an economy) in the global market. It is an external, performance-based evaluation of the economy as a whole.

2) What have been the changes in U.S.-international arms trade? Parallel to the question above, this addresses the issue of the competitiveness of the U.S. arms industry in the global arms market. It, too, is a performance-based evaluation of the U.S. arms industry.

Finally, some definitions of terms peculiar to international trade are presented. The two context questions and definitions build the foundation for later material and are presented in the literature review (Ch.III). The changes in trade practices question is the primary objective of this research and is presented in later chapters.

### Justification

U.S.-international trade in general brings to the forefront of national concerns issues such as the deterioration of America's industrial base, technology transfer resulting in the development of future competitors, and of course, America's negative trade balances. U.S.-international arms trade adds to these concerns a national security dimension resulting in issues related to maintaining the "technological edge", to the desire of Americans to maintain within their shores the ability to wage a sustained war, and to the potential outflow of technology to the Eastern bloc (24:12). With such issues in the balance, this study seeks to identify the 'modus operandi' by examining the practices that prevail in this sensitive arena -- all from a historical perspective.

Additional utility is envisioned in that the changes and trends that are highlighted as a result of the analysis may or may not be the changes desired by policymakers and that this study may stimulate further research as a basis



for adjusting policies or exercising control to influence future outcomes.

Further utility of the study stems from the view that it is a feedback mechanism that shares with international program managers what trade practices and tools other international program managers have used in the recent past. They, of course, would be free to draw parallels between their programs and the programs presented in this study and extrapolate costs and benefits of alternative strategies they wish to pursue.

#### Sequence of Presentation

Chapter II presents the methodology of this research and its limitations.

Chapter III presents a review of the literature in the area of international trade in order to place later work in the appropriate context. In addition, definitions of terms that may be encountered in subsequent chapters are presented to facilitate understanding.

Chapter IV presents the data, so to speak. It provides descriptions of the weapon systems sold and descriptions of the deals by which they were sold.

Chapter V analyzes the data, derives conclusions, and summarizes the study.

## II. Methodology

### Chapter Overview

This chapter describes the methodologies employed to conduct this research, followed by a justification for the choices. It concludes with a discussion of the limitations of the work.

### Research Method

The primary objective of this study was to ascertain the similarities and differences between two periods with regard to practices, all within the context of U.S.-international arms trade.

To ascertain similarities and differences in trade practices, it was necessary to define the population of trade endeavors in each of the two periods, observe the frequency of the trade practices of interest, and build period profiles. For each item of interest, these period profiles were compared to yield similarities and contrasted to yield differences.

The populations of interest were large U.S.-international arms trade undertakings in each of the two periods (1980-84 and 1985-89). An arbitrary threshold of 900 million dollars was used to screen all known undertakings discovered in sources accessed during the literature review. Additional effort was expended to assure no major undertakings were missed.

The 900 million dollar threshold was selected because there seemed to be a natural break in the data between 700 and 900 million dollars. Furthermore, eighteen datapoints were considered adequate for trend analysis and did not present an overwhelming number of programs to research. Coincidentally, nine datapoints fell into each period and eliminated the need to normalize (adjust for difference in quantities) the data. This facilitated simple and direct analysis.

Each of the identified candidates that exceeded the threshold was analyzed to reveal the necessary trade practice information by using the historical method. The historical method is defined as "the systematic and objective location, evaluation, and synthesis of evidence in order to establish facts and draw conclusions concerning past events" (7:260). If, however, significant gaps existed in the information available, and the answers to the trade practice questions of interest were not satisfactorily documented, the candidate was further examined via interviews -- personal, when possible and telephone, when not. Someone that was knowledgeable with the undertaking and had first-hand exposure to aspects of the deal was identified and contacted. Typically, these individuals were found at the program office level.

A profile of the entire period was then synthesized by comparing the frequency of occurrence of certain trade practices. As an example, Memoranda Of Understanding were

used as the contractual document in 2 out of 9 undertakings during the second period. Period profiles were compared and contrasted and changes noted in the final chapter. To complete the example begun above, none of the undertakings in the first period used MOUs. The conclusion, therefore, was the rise of the use of non-LOA documents in the consummation of such undertakings in the latter half of the decade.

#### Justification

Since this study strives to rebuild events of the past to extract useful information for the future, it is restricted to methods used in the ex post facto realm. It is reliant on the historical method for secondary data and reliant on the survey method (of which interviews are a subset) for primary data.

#### Limitations

This study is subject to several limitations, the first of which involved cost. The data search strategy used was to access those databases first that did not incur charges-per-use. These included DoD databases such as DTIC and DLSIE and commercial databases such as ABI/Inform. Whenever these resulted in an inadequate pertinent information, charge-per-use databases were queried. Of these, PTS A/DM&T (Predicast's Aerospace/Defense Marketing and Technology) reported approximately 2000 "hits" on the eighteen sales.

Constrained by costs, this research was limited to the first ten articles per sale.

The second limitation was the population selected. Although the data accounted for a significant portion of total U.S.-international arms sales in dollar value, it was not representative of the entire population of U.S.-international arms sales conducted during the last decade. To illustrate this limitation, consider the year 1980. Total arms exports in that year were valued at approximately 9.1 billion dollars. The only sale of that year that is considered in this study is the F/A-18 sale to Canada valued at 2.7 billion dollars. While the Canadian sale accounted for 30 percent of the dollar value of total sales, it was only one of hundreds of arms transactions conducted that year and as such is not representative of the myriad assortment of activities called U.S.-international arms transactions.

The third limitation was the number of datapoints. Realists embrace datasets that number more than five or six comparable datapoints, while theorists reject datasets less than thirty as being inadequate for trend analysis. This limitation merely cautions the reader that some investigative questions were answered with six datapoints in each period while others were answered with nine in each period and that the reader must be mindful of this "statistical" deficiency when interpreting the results. The concern of theorists is that the results of the study may

not be generalizable to the entire population of international arms programs.

The final limitation was the level of depth or lack thereof. Instead of taking a thin slice of a subject and cutting it deep (i.e. learning everything about it) the intention of this study was to take a wider slice and cut it shallow. Such a strategy necessarily resulted in a cursory look at a good number of programs.

### III. Literature Review

#### Chapter Overview

This chapter is the result of a review of the significant literature on international trade. It helps to put the study of international arms trade in the wider context of U.S.-international trade. It first evaluates U.S. competitiveness in international trade and then focuses on worldwide U.S. arms competitiveness. Both evaluations are external and performance-based. The chapter concludes with definitions of terms that may be encountered in the course of the research.

#### Changes in U.S.-International Trade

For two decades after World War II, international trade played a minor role in the functioning of the American economy. It was almost wholly dependent on the internal conditions of the country. The U.S. enjoyed a dominant trading position with virtually all its international trading partners due largely to its strengths in capital goods, transportation, scientific equipment, and other high-tech industries. Since then, however, international trade has become a significant part of the American economy as measured by the ratio of exports and imports to Gross National Product (GNP). This is illustrated in Table 1 below.

TABLE 1  
CALCULATIONS OF EXPORTS + IMPORTS  
AS A PERCENT OF GNP

---

<u>Year</u>	<u>Exports</u>	<u>Imports</u>	<u>Exp + Imp</u>	<u>GNP</u>	<u>Exp+Imp/GNP</u>
1970	42.0	40.0	82.0	1016	.08
1980	216.5	244.9	461.4	2732	.17
1985	206.9	345.3	552.2	4015	.14
1988	308.0	440.9	748.9	4881	.15

---

Source: U.S.Department of Commerce

---

Increasingly, "critical decisions about U.S competitiveness are being determined by other countries whose national strategies are more adaptive than ours" (60:7). As an example, some countries incentivize work, saving, and investment while the U.S incentivizes consumption (even if financed by borrowing) and leisure. Some countries offer incentives to exporting industries, but U.S. policy offers to shelter industries from foreign competition (60:7).

The United States faces key challenges in many sectors, not only from Western Europe, but from the Pacific Rim (Japan, South Korea, Taiwan, Singapore, and Hong Kong) as well. In addition, these challenges come in sectors that have been considered America's traditional strengths -- high



technology sectors. These challengers have capitalized not on natural resources, but on man-made ones. Resources such as technology, capital investment, and labor skills. A key characteristic that distinguishes man-made resources from natural resources is that man-made resources are mobile and move across boundaries readily. Thus, national environments exert considerable influence over where those resources will move. The strength of Pacific Rim nations is that they have successfully manipulated their national environments through the use of coherent national strategies. For example, Japan has made a concerted effort to:

- a) increase productivity in existing activities, and
- b) shift resources into activities that promise above average growth and/or technological change.

The national environments created by the United States and other Western countries have been faulted for not being as conducive as those of Pacific Rim nations. These environments are claimed to be less competitive and more focused on:

- a) secure and equitable distribution of current income, and
- b) current consumption even at the expense of long term investment (60:2-5).

It is as if the United States has been accustomed to fielding a football team of eleven rugged, "independent" athletes and watching them win game after game. Now, confronted by teams that have practiced their "plays" and are "coached" by their governments, the U.S. finds all the games' scores are closer and there are a disturbing number of losses. New rules and better enforcement can deal with some aspects of the

situation, such as "unnecessary roughness" or "holding". But, it is naive to think that our competitors should abandon plays requiring practice and coordination merely to fit our ideas of rugged individualism refereed by government: in other words, it is hard to see why "our rules" should prevail. (61:139)

As noted above, the U.S. is losing its capacity to compete in the world economy, particularly in the manufacturing sector (11:1). Statements describing this state of affairs are no longer news. A common framework used to evaluate a country's competitiveness is based on:

a) Trade balances or net exports. These measures indicate the net value of cash flows from the trade of merchandise. Table 2 presents the dramatic deficit trends of the late eighties.

TABLE 2  
TRADE BALANCES

---

<u>Year</u>	<u>Balance on Merchandise Trade (in \$ B)</u>
1970	2.6
1980	-25.5
1985	-122.1
1988	-127.2

Source: U.S. Department of Commerce

---

b) Rate of Return on Capital. This is a key determinant of the economy's ability to produce financial returns that attract investment. Shown below (Table 3) is the real rate of return on capital in manufacturing. The returns are well below alternative investments, and challenges the wisdom of the investor who chooses to fund America's manufacturing base. The President's Commission reported that

In the 1960's, the real rates of return earned by manufacturing assets were substantially above those available on financial assets. Today, the situation is reversed. Passive investment in financial assets has pretax returns higher than the rates of return on manufacturing assets. As a result, the relative attractiveness of investing in our vital manufacturing core has been compromised. It is no wonder that needed investments have gone unmade and a short-term bias has crept into business and investor decisionmaking. (54:12)

TABLE 3  
RATE OF RETURN ON CAPITAL

---

<u>Year</u>	<u>Real Rate of Return in Manufacturing</u>
1970	3.8 %
1980	2.3 %
1983	2.1 %

Source: U.S. Department of Commerce

---

c) Real, after tax earnings of American workers. This is a measure of the standard of living of a sector of workers. Table 4 presents one such measure, the weekly earnings of manufacturing workers in constant dollar terms.

TABLE 4  
REAL, AFTER TAX EARNINGS OF AMERICAN WORKERS

---

<u>Year</u>	<u>Weekly Earnings (1977 \$) in Manufacturing</u>
1970	187
1980	173
1985	170
1988	168

Source: U.S. Department of Commerce

---

d) Finally, productivity measures are frequently used to compare competitiveness. In this case, however, productivity growth rates are compared across countries. Shown below (Table 5) is such a comparison:

TABLE 5  
INTERNATIONAL PRODUCTIVITY GROWTH RATES

---

<u>Country</u>	<u>Productivity growth rate for 1950 to 1987</u>
U.S.	1.9 %
Canada	2.7 %
France	3.1 %
Germany	3.7 %
Japan	5.8 %
U.K.	2.2 %

Source: Organization for Economic Cooperation and  
Development

---

Every indicator used in the framework above paints a dismal picture for U.S. competitiveness in the world marketplace. To help deal with this situation, both the President's Commission on Industrial Competitiveness and the Harvard Business School study, called for a fundamental reorientation of the U.S. basic economic strategy -- to either scale back our domestic goals and worldwide commitments or to incorporate strategies that improve the national environment and promote robust performance in the future (54:51-60, 60:1-2).

## Changes in U.S.-International Arms Trade

World Military Expenditures and Arms Transfers 1989 was released in October 1990 and reported World financial data on arms trade through 1988. It reported that:

- World arms trade has seen a decline (in constant dollars) averaging nearly three percent per year since 1983.

- World arms trade declined even further, by 13%, in 1988 from \$ 56 B to \$ 49 B.

- International arms trade as a percent of total international trade fell from 2.7% in 1984 to 1.7% in 1988 (2:7).

However, U.S.-international arms exports remained brisk.

The World Military Expenditures and Arms Transfers 1989

further reported that:

- U.S. arms exports in 1987 and 1988 were over \$ 14 B, their highest levels for the decade.

- U.S. market share of the World arms market actually grew from 17.9 % in 1980 to 29.6 % in 1988 as illustrated in Table 6.

TABLE 6  
MARKET SHARES OF INTERNATIONAL ARMS TRADE

---

<u>Year</u>	<u>U.S. Market Share</u>	<u>U.S.S.R. Market Share</u>
1980	17.9 %	47.7%
1981	19.4 %	40.6%
1982	19.4 %	39.9 %
1983	23.6 %	39.1 %
1984	20.4 %	36.9 %
1985	23.9 %	37.0 %
1986	20.0 %	45.6 %
1987	26.4 %	41.1 %
1988	29.4 %	44.0 %

Source: World Military Expenditures and Arms Transfers 1989

Note: Prior to the conclusion of this study, the Center for Defense Information released the 1990 market share information: U.S. share at 40 percent and U.S.S.R. share at 29 percent (77:7A).

---

Using this framework to evaluate U.S. competitiveness in the international arms trade arena, it is evident that despite smaller markets and an eroding industrial base, U.S. competitiveness is actually making headway by setting records both in current terms (with inflation) as well as real terms (after adjusting for inflation).

## Definitions

To avoid misconstruence in the usage of terms peculiar to the international trade business, the following definitions are offered:

### International Cooperative Programs

Dr. Farr defines international cooperative programs as "the non-repetitive transfer of technology across international boundaries among collaborating organizations" (19:14). He further narrows the focus to international armament cooperative programs as the sharing of costs and responsibilities between two or more nations or organizations in the performance of a joint program. This may include codevelopment, cooperative research and development, coproduction, or licensed production (19:14-16). Dr. Farr further suggests the following definitions that are in consonance with the definitions suggested by the Defense Systems Management College (DSMC) in its Guide for the Management of Multinational Programs:



#### Codevelopment

Development of a system by two or more nations in which the costs of development as well as the design effort are shared.

#### Cooperative Research and Development

Any method by which governments cooperate to make better use of their collective research and development resources to include technical information exchange, harmonizing of requirements, codevelopment, interdependent research and development, and agreement on standards.

#### Coproduction

Any program whereby a government, international organization, or designated commercial producer acquires the technical information and know-how to manufacture or assemble defense equipment or components developed by another country

#### Licensed Production

Involves agreements made by U.S. commercial firms with international organizations, foreign governments, or foreign commercial firms for the production of specified items.

#### Foreign Military Sales (FMS)

A form of world wide U.S. security assistance that requires foreign recipients of U.S. defense articles/services to provide reimbursement in accordance with established procedures. There are numerous types of FMS programs, and a variety of financing arrangements. It is distinct from cooperative programs in that foreign countries involved in FMS programs are "customers" in a "sales" environment. Barring exceptions, there is little opportunity for input to the design or production of the article/service being purchased.

#### Memorandum Of Understanding (MOU)

A written arrangement or understanding between governments and/or international agencies, setting forth the terms under which they will cooperate in the performance of certain work such as research, development, production, or utilization. The MOU usually sets down, in broad terms, the objectives of the program, the work to be performed by each participant and its financing, the rights to technical data and patents to be acquired, and other necessary

elements concerned with the administration and the performance of the program.

Offset Agreements

Any agreement by U.S. program participants to purchase items or services from a foreign nation, or to place a specified amount/percentage of work with that nation to compensate for its expenditures on U.S. defense items.

Direct Offsets

An offset agreement that is fulfilled from within the specific cooperative project that has been undertaken by the participants.

Indirect Offsets

An offset agreement that may be partially or wholly fulfilled through the purchase of items/services unrelated to any specific cooperative project.

(19:193-195)

#### IV. Presentation of the Data

##### Chapter Overview

This chapter presents the data. It opens with the descriptions of the systems sold over the entire decade to acquaint the unfamiliar reader with them. The chapter concludes with a narrative description of facts of interest for each major sale. The sales are divided into two periods and presented chronologically from the first sale of the decade to the last.

##### Weapon Systems Descriptions

###### F/A-18 Hornet

Designed to replace the F-4 in the fighter role as well as the A-7 in the attack role, the F/A-18 Hornet was first produced in 1980 by McDonnell Douglas (prime contractor) and Northrop (principal subcontractor). Armed with an M61 20mm six barrel nose gun, the F/A-18 is outfitted with fuselage mounted Sparrow missiles when performing in the fighter/interdictor role. These are replaced by Forward Looking Infra-Red (FLIR) and a laser tracker when performing in the attack role. The Navy has since adapted the F/A-18 to perform simple reconnaissance duties by replacing the nose gun with a twin sensor package. The adapted

version is called the F/A-18(RC) and is convertible to the fighter/attack version overnight. Powered by two General Electric F404-GE-400 low bypass turbofans with afterburners, the first F/A-18s were single seaters and were designated to be F/A-18As. Tandem two-seaters were added soon thereafter and designated F/A-18Bs.

F/A-18As and F/A-18Bs purchased after 1986 incorporated the ability to carry six AMRAAM missiles, four imaging infra-red Maverick missiles, a self protecting jammer, reconnaissance equipment, upgraded stores management, Flight Incident Recorder And Monitoring Set (FIRAMS), built-in test capabilities, a maintenance status panel, and a new mission computer with higher processing speed and twice the memory. These were designated the F/A-18Cs (one seaters) and the F/A-18Ds (two seaters).

Capabilities were further enhanced on models produced after 1989 when FLIR was modified to provide TV-like images on a raster lead-up display and all-weather night attack capability (including pilot's night vision goggles) were added. In addition, the F/A-18 was modified to have a fully mission capable rear cockpit so that

the rear operator was able to control weapons delivery when used in the attack role (69:452-4).

#### F-16 Fighting Falcon

Standard equipment in TAC, USAFE, PACAF, ANG, and AFRES, this is the staple air superiority fighter of the USAF. Designed to fulfill air-to-air and air-to-surface roles, the F-16 was first delivered in 1978 by General Dynamics. Subcontractors included Westinghouse (radar) and Pratt and Whitney (F100-PW-200 turbofan engine with afterburners). The single seater was designated the F-16A and the tandem two seater, each fully systems operational, was designated the F-16B.

The F-16 is air-to-air capable with its M61A-1 20mm multibarrel cannon mounted in the port-side wing/body fairing and its Sidewinder missiles. It is air-to-surface capable with its cannon, its rockets, its conventional bombs, its special weapons, and its laser-guided and electro-optical missiles that include Sparrows, Skyflashes, Mavericks, and AMRAAMs (67:410-3).

In 1980, USAF implemented a three phased upgrade program called the Multinational Staged Improvement Program (MSIP) which facilitates future growth of the aircraft. Phase I consisted

of wiring and structural provisions. Phase II incorporated avionics, cockpit, and airframe changes. Phase III involves the installation of advanced systems as they become available. Phase III installations are normally done in blocks but, sometimes done in mini-blocks. F-16s with capabilities of the MSIP program are designated F-16Cs (one seaters) and F-16Ds (two seaters). Thus, some F-16s emerge from the production line as F-16Cs and F-16Ds while others are retrofitted with MSIP capabilities and redesignated F-16Cs and F-16Ds. It is important to note that F-16As and F-16Bs continue to be produced as well. In addition, these may incorporate certain block upgrades without being redesignated (8).

### E-3 Sentry AWACS

The E-3 Sentry Airborne Warning And Control System (AWACS) fulfills dual needs: as a command and control center to support quick reaction deployment and tactical operations, and as an early warning command and control center for identification, surveillance, and tracking of airborne enemy and friendly forces. It accomplishes its missions by employing a 360 degree surveillance radar housed in a rotodome mounted on the fuselage of a militarized Boeing

707-320B airframe. The radar's inputs are integrated with other sensory inputs by a highly sophisticated avionics suite manned by a crew of up to seventeen members.

Radar detection range for low-flying (200 ft. altitude) small aircraft is 175 nautical miles (nm) from normal AWACS mission altitude (29,000 ft). Medium sized targets can be seen at 240 nm if they are above the radar horizon. Detection range for high altitude, bomber size target aircraft is 360 nm. Ground targets (tanks, trucks) cannot be detected or tracked. Small maritime targets can be detected and tracked in low-moderate seas. Medium and large targets can be detected in moderate-high seas (72:60).

The first twenty four of USAF's total thirty four AWACS were designated core E-3As while the last ten (and NATO's eighteen) were designated standard E-3As. Standard E-3As incorporated an active maritime surveillance capability, a CC-2 computer, additional HF radios, jam-resistant voice communications, and ECM (Electronic Counter Measures) capability.

A Block 20/25 modification program upgraded the core E-3As and standard E-3As (U.S. only) to E-3Bs and E-3Cs respectively. The modification closed the capability gap between the two models

by equipping the core models with a passive maritime capability, a computer, additional radios, voice communications, and ECM. Furthermore, the mod-block added five more operator consoles, five more UHF radios, and provisions for Have Quick, a frequency hopping communications capability to both the core and standard models.

A Block 30/35 modification program is currently underway that incorporates bubble memory into the CC-2 computer, GPS (Global Positioning System) capability anti-jam communications via JTIDS (Joint Tactical Information Distribution System), and ESM (Electronic Support Measures). The only upgrade that NATO is participating in is the ESM upgrade whereby the AWACS will be able to match and identify hostile and friendly electronic signatures against a pre-loaded emitter library (34).

Boeing was the initial prime contractor with Westinghouse as a principal subcontractor responsible for the radome and with Pratt and Whitney responsible for the T-33 turbofan engines. Follow-on E-3 purchases (by Saudi Arabia, U.K., and France) were powered by the more fuel efficient GE/Snecma CFM56-2 engines. Boeing



continues to be the sole source prime contractor for the upgrades (68:371).

#### Patriot Missile System

Designed to replace the Nike Hercules and some HAWK systems, the Patriot's mission was to provide defense against high performance aircraft at all altitudes as well as short-range missiles. Thus, the Patriot is a long-range, high-speed guided weapon system. Providing remarkable performances in heavily jammed environments, it uses multiple guidance modes for accurate interception. It uses redundant secure communications datalinks to assure remote control of the system.

The Patriot missile system is highly manœuvrable since all its units are truck or trailer mounted. Each Patriot fire unit consists of an Engagement Control Station (ECS), a single radar set and an antenna mast group, either eight or sixteen launch stations, and four missiles per launching station.

The ECS is the command and control center. It has the weapons control computer, the man-machine interface, and communications terminals. This is the remote control headquarters.

The radar set and antenna mast group performs the functions of surveillance, target detection, and tracking and support of missile guidance. It reports to the ECS.

Each launching station houses a diesel electric generator, VHF datalinks to the ECS, an electronic launching assembly, and four missile canisters.

Each missile is an MIM-104 featuring a single-stage, all-boost, solid-propellant rocket that requires no maintenance after production certification. It carries a high explosive fragmentation warhead and is capable of outmaneuvering and destroying "any air-breathing threat" including conventional and stealth aircraft as well as cruise missiles (4:189-91).

Applauded for its role in Desert Storm in destroying Soviet-built Scud missiles, the Patriot system embodies relatively simple components and technology integrated by a sophisticated control center.

#### M1A1 Abrams Main Battle Tank

The M1A1 has its roots in the XM1 and the M1. The first M1A1 was produced in 1985 by General Dynamics (GD) Land Division (then called the Defense Division of Chrysler Corp.). In 1984,

when the U.S. Army selected the 120mm Rheinmetall smooth-bore gun for the M1, the resulting tank was dubbed the M1A1 Abrams Main Battle Tank (MBT). In addition, the M1A1 integrated an NBC system that provided the crew with conditioned air.

The crew consists of a commander, a gunner, a loader, and a driver. Standard crew protection equipment includes a Radiological Warning Device (RADIAC), a chemical agent detector kit, a collective NBC protection unit, and personnel heaters. The crew is separated from the fuel by bulkheads.

The fuel that drives the AGT 1500 gas turbine is kerosene-based, however, it can be driven by gasoline in emergencies. The turbine is coupled to a General Motors (GM) automatic transmission that provides four front and two reverse speeds, steering action, and braking action.

The M1A1 main firepower is delivered via the 120mm gun for which it carries 40 rounds. In addition, it has two M240 machine guns mounted on top for which it carries 4400 rounds. Finally, it has a M2 HB machine gun at the commander's station for which it carries 1000 rounds and two smoke dischargers.

Incorporating advanced armor construction that is impenetrable by conventional battlefield weapons, blow off panels, and extremely responsive

fire sensing and control system, the M1A1 protects its crew effectively. Incorporating advanced infra-red imaging and display technology, a laser range finder, multiple environmental sensors fed into a computer, and a stabilization system that permits accurate firing-on-the-move, the M1A1 accomplishes its missions effectively.

As eluded above, GD Land Division is the prime contractor, Rhienmetall is the main gun subcontractor, GM is the Transmission subcontractor, and Honeywell and Olin Defense are ammunition subcontractors (20:140-5).

#### Fighter Support-Experimental

Proclaimed to be a derivative of the F-16, the FS-X is being codeveloped by the United States and Japan, based on requirements set by the Japanese Air Self Defense Force (JASDF). Its primary missions are anti-shipping and interdiction. As secondary missions, its roles would be close air support and air-to-air combat. It will replace the Japanese developed F-1 support fighter now reaching the end of its useful life.

While maintaining a strong visual resemblance to the Block 40/50 F-16 C/D, there are, nonetheless, significant changes. New wings with 25 percent increased area and high strength

composite materials will allow significant increase in load out, especially of large surface-to-air weapons. New avionics, some of Japanese design, will include radar, electronic warfare system, navigation system, mission computer, data links, communications gear, and pilot displays. The aircraft will incorporate the new "increased performance" version of the General Electric F-110 engine (USAF designation F110-GE-129). The horizontal and vertical tail areas are increased and the fuselage is stretched sixteen inches over the F-16 for increased avionics and additional internal fuel. The FS-X will employ vertical canards similar to those explored in the F-16 AFTI program to increase maneuverability.

To perform its primary mission, the aircraft will have a relatively long range. It will incorporate a modern stores management system, nine store stations, two wing tip launch rails, and an internal 20mm gun. Initially, it should be capable of carrying AIM-7F, AIM-9L, guided and unguided bombs, cluster bombs, rockets, and Japanese developed air-to-surface missiles. Centerline and inboard stations will be "wet" and capable of carrying 300 or 600 gallon fuel tanks. Growth capabilities being considered are AIM-7M, AIM-9M, AMRAAM, Japanese developed short and

medium range air-to-air missiles, anti-radiation missiles, and a 30mm gun pod (40:1)

In summary, with considerably more weight, larger wings and tail, and longer fuselage, the FS-X will be noticeably bigger than the F-16C/D, although it will still look like it. It is essentially a modern, all-weather, medium attack aircraft with some counter-air capability. Mitsubishi Heavy Industries (MHI) is the prime contractor while General Dynamics (GD) is a principal subcontractor (23:128-130).

## Description of Individual Sales (1980-1984)

### Sale # 1. F/A-18s to Canada

In 1977, Canada authorized a replacement fighter for its aging fighter fleet. The program was called the New Fighter Program (NFP) with a budget of about two billion dollars and the objective of acquiring 130-150 aircraft. Cost was used as the basis to down-select from bids submitted for the F-14, the F-15, the F-16, the F/A-18, and the Tornado to two finalists, the F-16 and the F/A-18. In 1980, the F/A-18 was selected at an overall cost of 2.7 billion dollars for 138 aircraft of which 113 were F/A-18As and 25 were F/A-18Bs (for additional details, see system description for F/A-18)(53:1). The reasons cited for selecting the F/A-18 over the F-16 were:

- 1) the F/A-18 has a lower attrition rate. Since it has two engines, the F/A-18 can better survive the loss of an engine than can the F-16 with a single engine.
- 2) the F/A-18 has greater growth potential for incorporating future capabilities.
- 3) and McDonnell Douglas Corporation (MDC) offered a more attractive offset package.

The Canadian Government signed a Foreign Military Sales (FMS) contract, referred to as a Letter Of Agreement (LOA) or DD Form 1513, with the

U.S. Government for the purchase of the aircraft while accepting MDC's offset package valued at 2.7 billion dollars over a period of fifteen years. Canada turned down proposals to assemble (final assembly) and test the aircraft, to coproduce the aircraft, and to license-produce the aircraft, effectively forcing McDonnell Douglas to turn to indirect offsets as a major vehicle to satisfy their offset obligations. The U.S. Government did not guarantee MDC's offset commitments.

Approximately 85 percent of the offsets incurred by MDC and its subcontractors were indirect. Over half of these were provided to Canadian aerospace firms in the production of aircraft subsystems to be used in a wide variety of MDC's aircraft such as the CF-18 (as the Canadian F/A-18s are called), the F/A-18, the MD-80, the DC-10, the KC-10, and the MD-11. Another significant portion of the offset package was satisfied by General Electric's (GE) creation of a manufacturing plant in Bromont, Quebec to produce engine components for the CFM56 and F110 engines. The total offset package was estimated to provide Canadians with some 24,000 jobs over the life of the program. However, since some of this activity would have occurred as part of normal business anyway, and by the very nature of U.S.- Canadian relations, the Canadian offset



package was not subjected to the same controversies that later offset packages to other nations were. In addition, the U.S. Government waived some 121 million dollars in Research and Development (R & D) recoupment charges as part of the deal. Finally, it is estimated that state-of-the-art manufacturing technology was transferred to Canadian industry and that the technology transfer was one-way (49:62-7).

#### Sale # 2. F-16s to the Netherlands

As a result of a joint decision by five nations (United States, Belgium, Denmark, the Netherlands, and Norway) to procure the F-16, the Multinational Fighter Program (MNFP) was born in June 1975. Sometimes referred to as the 998 Program, the MNFP sought to acquire a total of 988 aircraft, 650 for the U.S. and 348 for the European Participating Group (EPG). Belgium ordered 116 aircraft; Denmark, 58; the Netherlands, 102; and Norway, 72 (1:1-16). The MNFP authorized, among other things, an offset package that created three categories of purchases: the initial 998 purchases, third country purchases, and follow-on EPG purchases, each with its own set of offset obligations. To meet these commitments, General Dynamics (GD)

subcontracted the production of F-16 components, avionics, and support equipment to some thirty European companies. In addition, it established final assembly lines in Belgium and the Netherlands. GD's offset commitments in this program are guaranteed by the U.S. Government (48:54-7). While the last of the 998 deliveries were concluded in February of 1985, the program lives on to ensure its offset obligations are met with regard to third country sales and EPG follow-on buys (45). The EPG chose to call its original programs Harvest Partner I through Harvest Partner IV.

In 1980, the Government of the Netherlands conceived Harvest Partner V by contracting to purchase an eventual (in four slices) 111 additional F-16s to replace their F-104s (9). An LOA was signed between the U.S. Government and the Government of the Netherlands in the value of 1.3 billion dollars that incorporates the MNFP agreement by reference (53:2, 75). The MNFP agreement sets the offset requirement for EPG follow-on buys at a minimum of 58 % of the procurement value to benefit the EPG countries as a whole. The entire package consists of direct offset commitments (45).

The LOA purchases ninety seven Block 15 F-16As and fourteen Block 15 F-16Bs powered by Pratt and Whitney's PW-200s and PW-220s and equipped with Orpheus Reece Pods, Campal Mission Support, and drag chutes (see F-16 system description for additional details). Deliveries began in July 1984 and end in February 1992.

A direct fallout from the establishment of coproduction was the one way flow of significant manufacturing technology to the EPG. Furthermore, under the terms of the original MNFP agreement, no R & D recoupment was charged for the release of the F-16 related technology (76).

### Sale # 3. E-3s to Saudi Arabia

Easily the largest sale of the decade, the Air Defense Package sold to Saudi Arabia included five E-3A AWACS, eight tankers (KE-3As), a ground based command and control system, and an upgrade package for their recently purchased sixty F-15s. In addition, it provided personnel training and support at many levels.

Several major world events prompted the Saudis to embark upon their military build-up: the fall of the Shah of Iran, the beginning of the Iran-Iraq war, and the Soviet invasion of Afghanistan (11:37-57). As these events were

unfolding at or near its borders, the ground based radar warning system in place in Saudi Arabia only provided a 20-30 mile window. The Saudis sought to extend their window as well as promote the appearance of having a formidable internal defense capability (41:217-26). The AWACS extended their eyes to beyond 200 miles (see E-3 system description for further details) and the upgraded F-15s gave them lethal defensive capability while the ground based command and control system facilitated full exchange of data, etc (11:4).

The Air Defense Package was dissected into three programs:

- 1) Peace Sentinel acquired five standard configuration E-3As and eight tankers or KE-3As. The configuration of the E-3As was the USAF-NATO standard model without some non-releasable systems such as the Identification Friend or Foe (IFF) system plus releasable substitutes wherever possible. The tankers were modified KC-135s modified for drogue refueling capability only;
- 2) Peace Sun retrofitted the sixty F-15s with range extending fuel tanks and Sidewinder air-to-air missiles; and
- 3) Peace Shield acquired "a network of command centers, ground radars, and communication sites strategically placed throughout Saudi Arabia" (63:33-4).

Valued at 7.3 billion dollars, the FMS contract between the United States Government and the Government of Saudi Arabia contained no waivers from R & D recoupment charges (53:1). In

addition, Boeing did not obligate any offsets. Despite the conducive economic benefits of the sale, considerable political maneuvering was required to ensure the passage of the sale through Congress. Major critics of the sale were concerned, as the Israelis were, about granting an Arab nation a state-of-the-art surveillance system that essentially rendered Israel "naked" and a weapon upgrade that gave the Saudis a potentially offensive capability. Furthermore, critics argued that Saudi Arabia did not commit itself to providing anything in return (such as basing rights). This brought into question Saudi Arabia's long term commitment and loyalty to the United States. On the other hand, Saudi Arabia was a relatively stable, moderate Arab nation whose strategic geographic location would help the U.S. in keeping a watchful eye on several key choke points in the middle east and help deter Soviet aggression there. But most importantly, the unrestricted flow of Saudi Arabian oil was deemed vital to the national security of the U.S. Thus, to maintain Saudi Arabia as an ally and to maintain the credibility of the administration (which had pre-committed itself to the sale), the Air Defense package sale became absolutely

imperative. In 1981, the sale became a reality (13:17-20).

A decade later, a significant number of U.S. contractor personnel are still required to support the logistics, training, and maintenance functions in-kingdom on a day to day basis leading one to believe that very little, if any, technology transfer actually occurred as a result of the sale.

#### Sale # 4. F/A-18s to Australia

Culminating almost a decade of consideration to replace its Mirage IIIs, the Australian Government selected the F/A-18 to complement its F-111s. Designed to support the air-to-air combat role as well as the attack role, a total of seventy five F/A-18s (fifty seven F/A-18As and eighteen F/A-18Bs, see F/A-18 system description for additional details) were procured under the Royal Australian Air Force's (RAAF) Tactical Fighter Project (14:98). The original bidders included the P530 lightweight fighter, the F-15, the F-16, the F/A-18, the Viggen, the Tornado, and the Mirage 2000. Cost considerations eliminated all but the F-16, the F/A-18, and the Mirage 2000. Finally the F/A-18 was selected for its twin engine safety, its all weather avionics, and the

fact that the McDonnell Douglas offset package met the Australian government's stringent requirements.

In 1982, the Australian government signed an FMS contract with the U.S. Government at a value of 2.6 billion dollars for the purchase of the aircraft wherein the U.S.G. waived approximately 38 million dollars in R & D recoupment (53:1, 3:54). Deliveries were slated for 1984 through 1990. Subsequently, in 1983, MDC pledged roughly 800 million dollars in guaranteed offsets. The Australian government required at least 25 percent direct offsets to facilitate their stated objective of achieving self reliance in defense production, support, and maintenance. This was accomplished by creating a second production and assembly facility in Melbourne to be run by Government Air Factory (GAF, now called ASTA) where all but two of the aircraft were coproduced and assembled. Other arrangements that significantly contributed to satisfy the remaining offset obligations were the creation of General Electric's F404 engine component manufacturing facility and MDC's purchase of Australian airframe, radar, engine, and avionics for U.S. F/A-18s, DC-9s, and DC-10s. The offset package cost the Australian government a premium of about

fifteen percent but resulted in approximately two thousand jobs over the life of the program and a considerable influx of materials and manufacturing technology valued highly by Australian industry (49:67-73). While not directly linked, the U.S. gained approval to use Australian facilities for U.S.Navy aircraft shortly after the consummation of the deal.

#### Sale # 5. F-16s to Egypt

In its efforts to convert from old Soviet fighters and fighter-bombers such as the MiG-17, the MiG-23, the Su-7, and the Su-20 to U.S. fighters, Egypt has purchased 35 F-4Es and 173 F-16s to date. The F-16 purchases were accomplished in four separate phases: Peace Vector I through Peace Vector IV. Peace Vector II purchased forty F-16s of which thirty four were Block 32 F-16Cs and six were Block 32 F-16Ds (without AMRAAM capability) powered by Pratt and Whitney's PW-220 engines (see the F-16 system description for additional details). Unique equipment included an Egyptian Identification Friend or Foe (IFF) system and Singer's Inertial Navigation System (INS).

Since this was a follow-on buy, the formal competition process was not invoked. In May of 1982, the Egyptian Government signed an FMS



contract with the U.S. Government to procure the aircraft at a value of approximately one billion dollars, funded entirely by FMS forgiven credits generated by the U.S. Security Assistance program (53:1, 44:121). As is frequently the case, the Security Assistance package also waived R & D recoupment in conjunction with granting the forgiven credit. While General Dynamics investigated coproduction possibilities soon after the inception of the program, it was eventually deemed economically infeasible. As a result, technology transfer was limited to operational maintenance processes. The first aircraft was delivered in December of 1985 and the last one in June of 1987 (46:2).

Having been a staunch ally under President Sadat's leadership, Egypt was perceived as unstable in the wake of his assassination in 1981. Some Congressmen began to question its course and were hesitant to endorse the sale. However, President Reagan was successfully able to convince Congress to permit the sale (and even to grant unprecedented levels of FMS credits) by highlighting Egypt's continuing role in supplying arms to Iraq in the Iran-Iraq war (44:121).

#### Sale # 6. F-16s to Pakistan

Despite the existence of a bilateral security agreement between the United States and Pakistan, the U.S. did not support Pakistan in its conflict with India, suspended military and economic aid for a period, and offered a meager 100 million dollars to help Pakistan defend its western border when the Soviet Union invaded Afghanistan. Eighteen months after the invasion, Pakistan experienced territorial encroachment by Afghan troops. Dictator Zia put U.S. reliability to the test by requesting F-16s (22:14-36). The response from the U.S. came to mean much more than just another arms sale. Overcoming Congressional misgivings about Pakistan's long term loyalty, Zia's political stability, and the impact of the sale on U.S.-Indo relations, President Reagan proposed a six year, 3.2 billion dollar military and economic aid package. President Reagan argued that Pakistan was strategically important to the U.S. not only due to its proximity to the Soviet Union, but also because it was a leader in the Islamic world and it shared close ties with several key Middle East nations. Pakistanis serve in the armed forces of eight other nations (22:14-54).

By December 1981, Congress passed the aid package of which the most significant (at least symbolically) component was the sale of 40 F-16s, funded partly by FMS credits. The F-16 sale was worth approximately 906 million dollars not counting the forgiven R & D recoupment charges. Approximately 70% of the value was funded by FMS credit while the rest was covered by Pakistan and Saudi Arabia. No offsets were considered or granted, implying minimal technology transfer.

Before making the request, Pakistan had considered the F-5, the F-15, the F-16, and the F/A-18 to replace its disintegrating fleet of F-86s. It settled on the F-16 for cost and logistical considerations, for its design stability, and for its superiority in fulfilling the dual roles of ground support and air-to-air combat. However, no formal competition was conducted. The implementing program came to be known as Peace Gate. Phase I provided for six Block 15 F-16s (4 F-16As and 2 F-16Bs) to be delivered within twelve months (diverted U.S. assets) while Phase II provided for the remaining thirty four (26 Block 15 F-16As and 8 Block 15 F-16Bs) to be delivered on a less accelerated schedule (79). Thus, the Government to Government LOAs were signed in December 1981 and deliveries

occurred from September 1982 to March 1986.

Pakistani F-16s are powered by Pratt and Whitney's PW-200 engines (for additional details, see F-16 system description) and are uniquely configured with the French targeting pod ATLIS II system (46:4).

#### Sale # 7. F/A-18s to Spain

At a cost of approximately 2.3 billion dollars, Spain purchased seventy two F/A-18s to replace its twenty year old F-4s and F-5s (53:1, 65:108). Initial bidders included the Mirage 2000, the Tornado, the F-16, and the F/A-18. The F/A-18's strongest competitor, the F-16 boasted a lower price. However, the Spanish government ranked offsets a top priority and viewed F-16 quality offset opportunities somewhat diminished after the initial and follow-on purchasing arrangements of the European Participating Group (EPG). Furthermore, recent F-16 sales to Egypt and Pakistan caused deliveries to be farther out than F/A-18 deliveries. After lengthy deliberations, the F/A-18 was selected and deliveries were slated for February 1986 through July 1990.

As the first European purchaser of the F/A-18, Spain aggressively sought offsets in order to

bolster its defense industry and to enhance other sectors of its economy. Valued at 1.5 billion dollars, MDC's offset package consisted of approximately 25 percent direct offsets and 75 percent indirect to be fulfilled over a period of thirteen years and subject to penalties for non-compliance. The manufacture of extensions, flaps, brakes, and stabilizers for the EF-18 (as the Spanish F/A-18s are called) fulfilled the direct offset requirements while indirect offsets took many diverse forms from selling Spanish shoes to helping a Spanish consortium buy a power plant in Maine to running an internship program for Spanish graduates in multinational corporations. While the offset agreement, signed in July 1984, contractually bound MDC to its obligations, it did not bind the U.S. government to them. The U.S. Government shares an FMS agreement with the government of Spain wherein some 36 million dollars in R & D recoupment were waived.

It is estimated that the offset work was instrumental in a one-way technology transfer in manufacturing technologies such as CAD/CAM, robotics, and composite cutting and curing as well as quality assurance and systems maintenance disciplines (49:74-8).

#### Sale # 8. F-16s to Israel

The Peace Marble program was conceived when F-16s intended for the Shah of Iran were diverted to Israel after his fall and upon the heels of President Jimmy Carter's Camp David accords. Peace Marble II was a follow-on purchase for 75 additional F-16s requested in 1982 and sold in August 1983 to be delivered from September 1986 through October 1988 (74). As the single largest recipient of Security Assistance, Israel paid for the entire 1.9 billion dollar program with FMS forgiven credit (53:1). Of course, R & D recoupment was also forgone as part of the FMS agreement that the Government of Israel shared with the United States Government. In conjunction with this sale, the Government of Israel was permitted to buy, under direct commercial terms, some low-level support. These direct commercial agreements were referred to as Licensed Technical Assistance Agreements (LTAAs) (31).

While offsets are generally not offered for sales paid for by Security Assistance funds, Israel managed to secure from General Dynamics, under a separate agreement, an offset package worth some 600 million dollars. Made up entirely of direct offsets, the package included coproduction of significant portions of the

airframe and some subsystems as well as the codevelopment of Rapport III (ALQ-178) with Loral (46:3).

Peace Marble II F-16s were purchased merely to complement the Israeli defense arsenal of recently acquired F-15s and F-16s. Although intended for defensive use only, Israel used Peace Marble I F-16s (with a top cover of F-15s) in an offensive attack on the Osiraq nuclear facilities in Iraq in June 1981 which resulted in a short-lived suspension of Peace Marble II deliveries (38:104-5). The Peace Marble II buy consisted of fifty-one Block 25 and Block 30 F-16Cs and twenty four Block 25 and Block 30 F-16Ds powered by General Electric GE-110 engines. The Israeli F-16s are unique, not only in their desert camouflage warpaint, but in their equipment as well. For instance, they have beefed-up landing gears, extended range fuel tanks, Dorsal fairings (F-16Ds only), and additional avionics (e.g. Rapport III) (46:3).

#### Sale # 9. F-16s to Turkey

Making it the largest single order of F-16s by a foreign customer, Turkey ordered one hundred and sixty F-16s to modernize its Air Force. The F-16 was selected over the F/A-18, in a formal

competition, for the first time since the mid-seventies. It was selected on the basis of its lower cost (the F-16 program cost one billion dollars less than the comparable F/A-18 program) and on the basis that it would be interoperable with other NATO forces (Belgium, Denmark, the Netherlands, Norway, and the United States) (21:D1-4). Instrumental in the selection process were the offsets offered by the competitors.

The General Dynamics (GD) 100 % offset package included direct offsets used to build a coproduction facility in Turkey where extensive airframe, engine, and avionics subsystems were to be produced and where all but eight of the aircraft were to be assembled. Tusas Aerospace Industries (TAI) in Ankara and Tusas Engine Industries (TEI) in Eskisehir were the principal benefactors of this arrangement. In addition, another 1.3 billion dollars were committed in indirect offsets by GD and its major subcontractors (64:21). The offset agreement was signed separately and to which the United States Government was not a party. The Government to Government LOA was signed in December 1983 for the delivery of the first eight aircraft between October 1988 and January 1989 and the production and delivery of the remaining aircraft in Turkey



through December 1994. The LOA was valued at almost four (3.9) billion dollars of which approximately 75 % was funded by FMS credits (53:1, 12). To facilitate the creation of the production line in Turkey, the U.S. Government released substantial technologies for transfer and waived R & D recoupment charges.

Under this program, called Peace Onyx, Turkey was to acquire a hundred and thirty six Block 30B and Block 40 F-16Cs and twenty four Block 30B and Block 40 F-16Ds powered by General Electric GE-110 engines (see F-16 description for additional information). Turkish F-16s were to be uniquely outfitted with LANTIRN capabilities, drag chutes, and Rapport III (46:5).

The Turks have come to regard Peace Onyx as a resounding national success. The transferred technology has enabled them to springboard into such projects as coproducing trainers and light transports. In particular, it has helped them to almost single-handedly develop a multi-role unmanned air vehicle, WITNESS. Through the F-16 program, they claim, the new "Turkiye" has claimed its rightful place in the world and has achieved Attaturk's (father of modern-day Turkey) vision of "a successful economic future in the skies" (66:3-8).

## Description of Individual Sales (1985-1989)

### Sale # 10. Patriots to Germany

Paving the way for common NATO air defense, the U.S. government and the government of the Federal Republic of Germany founded an innovative program that permitted Germany to purchase Patriot missile systems without exceeding its budget limits. Under the Memorandum Of Understanding (MOU) between the two countries, Germany acquired a total of twenty-eight Patriot fire units, half of which it purchased outright from Raytheon through normal FMS channels while the other half it borrowed from the U.S. Army. These were U.S.-owned Patriot fire units scheduled for deployment in Germany. The units on loan are to be manned and supported by Germans as part of the arrangement. In return, Germany would committed 27 of the 95 newly acquired, German coproduced Roland missile systems to the defense of three U.S. air bases in Germany. Furthermore, the remaining 68 can be appropriated by U.S. forces in the event of a conflict (28:16).

The LOA for the purchased units was valued at 1.2 billion dollars (53:2). In a separate agreement, Raytheon agreed to provide German

industry 500 million dollars worth of offsets over a period of fifteen years. Direct offsets took the form of coproduction of the less sophisticated components such as motors, igniters, warheads, displays, antennas, batteries, and cables (see Patriot system description for additional details). The components that make the Patriot system a state-of-the-art air defense system continued to be produced in the U.S. Components such as the radars, missile guidance systems, and the software. However, one way technology was viewed as having occurred as a result of the sale particularly in advanced production management techniques that may be applied to the Roland production line. No indirect offsets were provided.

Concerns about German application of the production management techniques not only in the production of a directly competitive line of missiles (Roland), but in commercial applications as well, were at the forefront as Congress contemplated the sale. However, economic concerns were over-ridden by "foreign policy considerations and military operational requirements for the air defense of NATO Europe" (51:II23-II27).

Sale # 11. F-16s to Greece

In 1984, the Government of Greece elected to purchase forty F-16s directly from General Dynamics under terms of a direct commercial sale. It spent the next two years negotiating a satisfactory offset arrangement and subsequently signed a Firm Fixed Price contract with GD in 1987 valued at 940 million dollars (50:92-105). The original RFP required a very stringent 100 % offset package that gave only partial credit for a majority of purchases and that required credits to be pre-approved and post-approved by the Government of Greece. It also incorporated a fifteen per cent non-compliance penalty. GD found the package unacceptable and pursued alternatives until they finally settled on an innovative compromise.

The compromise, necessarily equal to the Turkish offset package at 100 %, consisted of a traditional coproduction arrangement worth approximately 240 million dollars and a 700 million dollar indirect commitment which was to be met through the operations of a venture capital company formed by General Dynamics; its major subcontractors, General Electric and Westinghouse; and the Government of Greece. The direct coproduction program involved the expansion of

Hellenic Aerospace Industries (HAI) capabilities so that it could produce fuselage sections, various engine components for the F110-GE-100 engine, a test cell for engines, and a depot capability for repairing and maintaining the engines. The venture capital firm formed to fulfill the indirect offset commitment is called the Hellenic Business Development and Investment Company and was capitalized at fifty million dollars by GD, GE, and Westinghouse.

While aircraft deliveries were slated for October 1988 through January 1990, the offset commitments were to be fulfilled over a period of fifteen years. The venture capital firm was designed to be a profit making undertaking for all parties (with an estimated Internal Rate of Return in excess of 17 percent) while conducting the business of meeting offset obligations. The firm was to make investments in the Greek industrial infrastructure by facilitating technology transfer, by creating high tech products, by promoting exports in new markets and by providing various types of assistance and arrangements beneficial to Greek companies.

Using this unique arrangement, GD effectively avoided the traditional adversarial relationship that was foreseen as a result of the pre-approval

and post-approval process. In addition, not only did GD avoid substantial costs in having to provide the organizational support normally required to implement traditional offset arrangements, it also created an opportunity to turn an additional profit beyond the sale of the aircraft. On the other hand, Greece theoretically gained a proactive role in the identification and selection of particular investments and a voice in directing resources to targeted sectors of its economy. In the worst case, if the venture capital firm fails, the Government of Greece stands to gain at least the initial fifty million dollars capital, according to the terms of the agreement (50:92-105).

It was estimated at the conception of the deal that the total offset arrangement would create 700 jobs a year and would result in one-way technology transfer, particularly in engine technology. To facilitate expeditious technology transfer and releasability issues through U.S. Government channels, the Government of Greece subsequently purchased, via FMS arrangements, some low-level support. The ensuing program was called Peace Xenia.

The forty Greek F-16s were comprised of thirty four Block 30E F-16Cs and six Block 30E F-

16Ds (see F-16 system description for additional details). Powered by General Electric GE-110 engines, their unique equipment includes Night ID lights, drag chutes, and two-way data links (46:6).

#### Sale # 12. E-3s to United Kingdom

When NATO selected AWACS as the platform to fulfil its airborne surveillance and command, control, and communications functions, U.K. opted to pursue the U.K.General Electric/ British Aerospace Nimrod AEW.3 program independently (71:31-47). A decade and 1.4 billion dollars later, it canceled the Nimrod and elected to purchase seven AWACS in December 1986. The initial competition included the E-2 Hawkeye, the P-30 Orion, the Nimrod AEW.3 and the AWACS, however, the Nimrod and the AWACS were the only aircraft that were deemed to fulfil the envisioned requirements. Only after Boeing up-ped its offset package and entered into agreements with three major British subcontractors did the U.S. company triumph over the British company. Subsequently, AWACS was declared to be technically less risky than the Nimrod (52:5-15).

The U.S.government cleared the way for the British government to purchase its aircraft

through direct commercial channels as well as granted waivers for the recovery of R & D recoupment. As a result, Boeing shared an agreement with the British government that promised delivery of the aircraft during 1991 and 1992 at a value of 1.1 billion dollars (52:5-15). An adjunct agreement was also signed that allowed for offsets valued at 130 percent of the procurement value or 1.4 billion dollars over an eight year period (6:53). Of the 130 percent, 10 percent was direct and the rest was indirect. The direct portion was to be satisfied by the Installation and Checkout (I & CO) work conducted at RAF Waddington by British Aerospace (5:12). The indirect portion involves some Strategic Defense Initiative (SDI) work as well as purchase of British "high tech" products. "High tech" was specifically defined by the British as products that "include innovative mechanical, electronic, or microwave technology" or products that "incorporate precision engineering or sophisticated manufacturing techniques". Examples provided for such products were radars, communication systems, flight computers, and Rolls Royce engines. The overall aim of the offset policy was to make British firms more competitive in the U.S. and other markets (52:5-15). The



offset program was estimated to employ approximately fifty thousand over the eight year period.

The British AWACS are non-MILSPEC (Best Commercial Practices instead), Block 20/25, USAF-NATO configuration, standard E-3As powered by four CFM56-2 turbofan engines and have the capability of being refueled by probe (see E-3 system description for additional details). They are also equipped with a British developed Electronic Support Measures (ESM) and the secure Joint Tactical Information Distribution System (JTIDS) communication link with USAF and NATO AWACS (5:12).

#### Sale # 13. F-16s to Israel

In accordance with Israeli strategy of maintaining a qualitative edge in the Middle East region, the Government of Israel continued its acquisition of F-16s equipped with state-of-the-art technologies, both U.S. and Israeli. Peace Marble III (PMIII) was conceived in May of 1988 to purchase sixty F-16s of which thirty were to be modified Block 40 F-16Cs while the other thirty were to be modified Block 40 F-16Ds powered by modified General Electric's large GE-110-100A engines. Not only were PMIII F-16s a more

advanced version of the PMII models, they also incorporated many more modifications and Israeli developed subsystems into the baseline. For instance PMIII F-16s have, in addition to PMII Rapport III, Israeli General Aircraft Computer (IGAC), Israeli Data Transfer Equipment (IDTE), Ring Laser Gyro (RLG), Night Vision Imaging Systems (NVIS), and Aft seat HUD Monitor (F-16Ds only) . Twenty PMIII F-16Ds also get Sharpshooter targeting pods (57).

Israel went beyond changing the aircraft configuration; it also changed its procurement strategy. This time around, it signed a direct commercial contract with General Electric for the engines for approximately 300 million dollars and signed a Government to Government LOA with the U.S. for the rest of the aircraft. The LOA, signed in May 1988, was valued at 1.3 billion dollars (53:2) and promised deliveries between May 1991 and December 1992. Even though the value of the LOA shrunk by 600 million dollars, the value of the offset package it signed with GD grew by forty million. The nature of the offset package also changed from all direct to 367 million direct and 272 million indirect (46:3). Two aspects of the deal remained unchanged: the acquisition continued to be funded entirely by Security

Assistance, and R & D recoupment was waived again. Furthermore, recent fair pricing legislation enacted by Congress forbade DoD from charging certain nations (of which Israel is one) for facilities rental and for salaries of military personnel supporting their acquisition programs (58).

Sale # 14. F-16s to Egypt

Under Begin's leadership, Egypt continued to foster its close security ties with the United States. F-16s continued to be approved for sale to Egypt under Peace Vector III (PVIII) and Peace Vector IIIA (PVIIIA) and purchases continued to be funded entirely by U.S. Security Assistance forgiven FMS credit (26).

Conceived in October 1987, Peace Vector III, as amended by PVIIIA in June 1990, manages the acquisition of forty seven additional F-16s. The government-to-government LOA promised thirty five Block 40 F-16Cs and twelve Block 40 F-16Ds to be delivered from August 1991 to April 1993 (46:2).

Valued at approximately 1.3 billion dollars, this was a straight FMS sale as was Peace Vector II (PVII). In other similarities to PVII, no significant direct commercial sales activity accompanied this sale, the U.S. government forgave

R & D recoupment charges, and offsets did not supplement the sale (53:2).

PVIII aircraft differed from PVII aircraft in that they were Block 40 F-16s as compared to Block 25 F-16s and that they were powered by General Electric's F110-GE-100 engines instead of the Pratt and Whitney PW-220 engines (see system description for additional details). In addition to PVII unique capabilities, PVIII aircraft carry buried structural provisions for Dorsal fairing and have AIM-7 capability using Egyptian developed Pulse Doppler Illumination (PDILL).

In conjunction with the aircraft sale, but not part of the LOA, was the purchase of design support toward the construction of a new Air Force base to house the aircraft and the purchase of considerable organizational maintenance training to maintain them. Since neither offsets nor depot capabilities were granted as a result of the sale, opportunity for technology transfer was presumed to be minimal, if any (25:1-6).

#### Sale # 15. F/A-18s to Kuwait

In 1988, the U.S. Congress approved the sale of F/A-18s to Kuwait, thereby embarking upon a new stage in the increasingly close U.S.-Kuwaiti security relationship since the reflagging of

Kuwaiti oil tankers in 1987. The sale also marked the first time the fighter-bomber was sold to an Arab nation or to a third world country. As discussed in earlier sections, the only other sales were to Canada, Australia, and Spain.

To specifically counter the Iranian threat, Kuwait considered the F-16 and the F/A-18 among others before deciding to request the F/A-18 on the basis of its twin engines and its interoperability with the aging A-4 fleet (78:1). As a condition of the sale, however, Congress required that Kuwait "trade-in" its A-4s on a one-to-one basis and sign numerous assurances on the use of the newly acquired capabilities. To appease the opposition further, it also agreed not to procure aerial refueling capability (which would extend the range of the F/A-18 beyond its standard 500 miles and give it the ability to reach Israel) (32:2).

Kuwait signed an FMS agreement with the U.S. Government in July of 1988 in the amount of 1.9 billion dollars (53:2). The agreement stipulates the details of the purchase of the forty aircraft (see F/A-18 system description for additional details) and related equipment and services as well as a large number and variety of weapons. The weapons included 200 cluster bombs, 120 AIM-9L

Sidewinders, 200 AIM-7F Sparrow air-to-air missiles, 40 AGM-84D Harpoons, and 300 AGM-65G Maverick air-to-surface missiles.

R & D recoupment charges were not waived by the U.S. government and no offset commitments were incurred by McDonnell Douglas in connection with this sale. At the inception of the deal, deliveries were estimated to begin in early 1993 and to conclude by 1994 (62:188). However, as a result of the Iraqi invasion of Kuwait in August 1990 and the ensuing world events, a weapon surge occurred, both in quantities and schedules and U.S. assets were diverted.

#### Sale # 16. F-16s to Pakistan

After the assassination of Dictator Zia, prime minister Bhutto of Pakistan successfully lobbied her country and the U.S. to permit follow-on purchases of F-16s. A token buy of eleven aircraft, purchased entirely by FMS credit, was conceived in December 1988 under Peace Gate III. it was followed by Peace Gate IV which purchased sixty additional F-16s. While the two buys were implemented almost as one at the program office level, it is the latter buy (Peace Gate IV) that is the focus of this discussion (79).

In September 1989, the government of Pakistan signed an LOA with the U.S. government to procure forty eight Block 15 F-16As and twelve Block 15 F-16Bs (see F-16 system description for additional details) at a value of 1.4 billion dollars (53:2). As a departure from earlier Peace Gate programs, this program was not funded by FMS credits; instead it was a cash FMS sale funded with significant Saudi aid. The LOA also differed from earlier ones in that the deliveries were scheduled over a longer than optimal period of time (September 1992 through August 1996).

Pakistanis prioritize interoperability and logistical considerations very high. Consequently, they chose to stay with Block 15 F-

16As and Block 15 F-16Bs and only upgraded them with Ring Laser Gyro (RLG) and Pratt and Whitney PW 220 engines. They also plan to retrofit Peace Gate I and Peace Gate II aircraft with the similar upgrades in the future (79).

As mentioned earlier, the first F-16 sale was the result of a litmus test of U.S. intentions toward Pakistan. The aircraft had since risen to become a national symbol and a source of great pride for the people of Pakistan. However, in late 1990, Pakistan managed to acquire an "explosive nuclear capability" which resulted in, among other things, a U.S. Security Assistance suspension. Under the terms of the suspension, all equipment deliveries, however small, are suspended until the capability is surrendered. Almost a year has passed since they acquired the capability and no moves signal surrender. It seems, as though U.S.-Pakistani relations are, once again, going to ebb. The impasse is further aggravated by the fact that the nuclear capability has also risen to the stature of a national symbol and is also looked upon zealously by the citizenry there (27:10).

The Pakistani F-16 production schedule has remained unchanged in hopes that a resolution shall be reached before deliveries are due to



occur. As with earlier sales, no technology transfer occurred as a result of this sale since no offsets were granted (79).

Sale # 17. M1A1s to Egypt

In its efforts to modernize its tank fleet, the Egyptian Army conceived four programs: three of which installed retrofit kits for the T-54, T-55, and the T-62 tanks and the last of which acquired the ABRAMS Main Battle Tank (MBT) M1A1 outfitted with the Rhienmetall 120 mm smooth-bore gun. The original competitors included the Vickers Mk7, the OTO OF .40, the GIAT AMX-40, and the M1A1 ABRAMS. It was presumed that the offer to fund the entire program through the use of FMS forgiven credit may have had some influence on the selection process (20:16).

The resulting MOU was signed in November 1988 which promised production of 555 tanks over a ten year period (73:19). General Dynamics (Land Division) and the government of Egypt negotiated an offset package that allowed Egypt, specifically, the National Organization for Military Production, to license produce and assemble (final assembly) the tanks in country. Approximately thirty five to forty percent of the tank was to be produced and all of the final

assembly was to occur at the new "Factory 200" north of Cairo (10:80). Thus, direct offsets account for approximately twenty per cent of the 2.3 billion dollar case to be fulfilled over the ten year life of the program (53:2). While the U.S. government did not guarantee the offsets, it did waive the R & D recoupment charges.

The initial Egyptian request was considerably more ambitious and far-reaching but was scaled down as political, industrial, and particularly, long term economic implications of the deal surfaced. As a result of industrial base concerns as well as security concerns, Egyptian industry was not permitted to produce components containing sensitive manufacturing technologies such as those associated with the manufacture of the turbine engine, the transmission, the composite armor, or the gun (43:43).

#### Sale# 18. FS-X to Japan

In 1985, the Japan Defense Agency (JDA) decreed it needed a replacement for its F-1, Japan's first domestically produced jet fighter. After ruling out the possibility of upgrading the license-produced F-4E, Japan began to look at either purchasing an existing foreign aircraft or domestically developing one. After various U.S.

interest groups came to bear pressure upon Japan in light of the trade balance and deteriorating trade relations, Japan agreed to suspend the domestic development option. However, after reviewing the F-16 and the F/A-18 and after conceding to internal political pressures, Japan decided to develop an advanced version of the F-16 to be called Fighter Support -Experimental (FS-X).

A government to government Memorandum Of Understanding (MOU) was signed in November 1988 whose stated goals were:

- 1) to support and improve the defensive capability of Japan,
- 2) to enhance the flow of Japanese military technology to the U.S., and
- 3) to provide meaningful workshare for U.S. industry.

While the original agreement was modified by a series of "clarifications" as a result of a highly charged political debate in early 1989, the goals remained remarkably unchanged. The debate brought to the forefront concerns about the U.S. creating a direct aerospace competitor of the future, about the eroding U.S. industrial base, about the value of the technology to be transferred to Japan, about the potential value of the technology to be transferred to the U.S., and of course about jobs being won or lost as a result of the deal. To

address these issues, the MOU contained language that provided the U.S.:

- 1) a 40 percent "quality" workshare in both development and production of the FS-X (to prevent the reduction of GD to the equivalent of a job shop),
  - 2) numerous assurances that U.S. would definitely be offered the coproduction program,
  - 3) a mechanism to limit access of F-16 technology, particularly, software source codes to only those who need it, and
  - 4) assurances of free and automatic flowback of F-16 derived technologies.
- (24:2-13)

In mid-1989, the JDA awarded the FS-X contract to Mitsubishi Heavy Industries (MHI), the Japanese prime contractor. MHI initiated with GD a License and Technical Agreement (LTAA) whose terms implement the joint codevelopment effort. Additional FS-X work will be carried out through commercial contracts between U.S. and Japanese firms. In addition, the government of Japan maintains an LOA with the U.S. government for low level support in the F-16 program office.

At inception, the FS-X program was estimated at six billion dollars for the development of six prototypes and the production of 120 "lightly modified" F-16s (23:140-2). The development portion had been estimated at 1.2 billion dollars, of which 480 million was to flowback to GD. The

development phase had been touted as resulting in 2700 manyears of employment while the production program would add another 20,000 manyears at an estimated value of two billion dollars (39).

If the promises of "free and automatic" flowback of technology do materialize, and if the flowback does indeed push the current state-of-the-art (such as they have the potential to do in composite wing technology and phased array radar technology), only then shall this have been the first true "two-way" technology transfer deal.

## V. Analysis and Conclusions

### Chapter Overview

This chapter analyzes the data, offers conclusions, and summarizes the results of the research effort. It presents the investigative questions in sequence. For each investigative question, the question is restated, profiles for each half of the decade are synthesized and subsequently compared to each other. Conclusions, conclusive or not, are drawn from the data and comments that may shed some light on the results are offered. Finally, the results are placed within the context of the overall research.

Before proceeding, it must be highlighted again that the data herein may not be representative of the full spectrum of U.S.-international arms sales that occurred during the decade. However, the data set constitutes a significant portion, in dollar value, of the total sales that occurred during said period.

### Investigative Question # 1.

Was there a difference in the types of weapon systems sold?

#### Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Weapon System</u>
1	Canada	F/A-18
2	Netherlands	F-16
3	Saudi Arabia	E-3, KE-3

4	Australia	F/A-18
5	Egypt	F-16
6	Pakistan	F-16
7	Spain	F/A-18
8	Israel	F-16
9	Turkey	F-16

Without exception, each of the sales in the first half of the decade involved an aircraft system.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Weapon System</u>
10	Germany	Patriot
11	Greece	F-16
12	United Kingdom	E-3
13	Israel	F-16
14	Egypt	F-16
15	Kuwait	F/A-18
16	Pakistan	F-16
17	Egypt	M1 tank
18	Japan	FS-X

Two of nine sales during the second half of the decade involved non-aircraft systems.

Specifically, the two exceptions were the sale of the Patriot missile system to the Federal Republic of Germany (FRG) and the sale of M1A1 ABRAMS tank to Egypt.

### Conclusion

The data suggests that the second half of the decade witnessed some diversification in the types of weapon systems sold. Of course, an alternative explanation is that the diversification existed in the first half as well, but that the case values of the non-aircraft system sales were below the 900 million dollar threshold and therefore not captured by this research.

### Investigative Question # 2.

Was there a difference in the customer base?

#### Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>
1	Canada
2	Netherlands
3	Saudi Arabia
4	Australia
5	Egypt
6	Pakistan
7	Spain
8	Israel
9	Turkey

Four of nine sales during this period were made to third world countries.



### Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>
10	Germany
11	Greece
12	United Kingdom
13	Israel
14	Egypt
15	Kuwait
16	Pakistan
17	Egypt
18	Japan

Six of nine sales during this period were made to third world countries.

### Conclusion

The data reveals that the latter half of the decade involved a greater number of sales to third world countries. In fact, two-thirds by number of sales, and more than that by value of sales, were made to countries in the third world. A noteworthy appearance is that of Japan, the only entry of a Pacific Rim nation in the entire data set.

Increased sales to third world countries has significant implications on issues ranging from successful program implementation to whether such a trend is a desirable U.S. foreign policy objective.

### Investigative Question # 3.

Was there a difference in the purchasing arrangements the U.S permitted its customers? Specifically, did the U.S impose "normal FMS channels" as the purchasing medium? The alternative, of course, is the Direct Commercial Sale (DCS) arrangement where the customer country or a customer country's company deals directly with a U.S. weapons manufacturing company.

It is important to note that there exists a dichotomy in the way that cooperative programs are conducted and viewed. Planners and negotiators of cooperative programs view the procurement and the accompanying offset conditions as one integral program. However, in the execution of the program, the procurement is disengaged from the offset commitment. The procurement activity is executed at the program level by using an LOA and the offsets are executed using an offset agreement. Thus, planners and negotiators view the procurement activity as part of a cooperative program executed using FMS documents while those executing the program view it as an FMS program that happens to have offsets associated with it.

The focus of this investigative question is on the procurement aspect of the sale and so it ignores the existence of offset agreements.

Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Purchasing Arrangement</u>
1	Canada	FMS
2	Netherlands	FMS
3	Saudi Arabia	FMS
4	Australia	FMS
5	Egypt	FMS
6	Pakistan	FMS
7	Spain	FMS
8	Israel	FMS/DCS
9	Turkey	FMS

Without exception, the principal purchasing arrangement for each of the sales was "normal FMS channels". Israel, however, was permitted to directly contract with U.S. firms for some low-level technical support for its F-16 purchase.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Purchasing Arrangement</u>
10	Germany	FMS
11	Greece	DCS
12	United Kingdom	DCS
13	Israel	FMS/DCS
14	Egypt	FMS
15	Kuwait	FMS
16	Pakistan	FMS
17	Egypt	FMS
18	Japan	DCS/FMS

In three of nine sales, "normal FMS channels" were displaced by direct commercial sales as the principal purchasing medium. Two sales, the U.K. AWACS sale and the Greek F-16 sale were contracted by the governments of those countries directly with Boeing and General Dynamics respectively. In addition, Israel's direct commercial activity grew from low-level technical support to low-level support plus the entire engine purchase from General Electric. Finally, the FS-X sale to Japan cannot be categorized neatly since the FS-X is Japanese-developed and Japanese-produced with offsets flowing to the U.S. No LOA exists between the two governments for the sale of F-16 technology, however, a License Technical Assistance Agreement (LTAA) exists between Mitsubishi Heavy Industries (MHI) and GD to assure the receipt of offset work. Thus, the principal purchasing arrangement was qualified as a direct commercial sale. The secondary arrangement, where the Japanese government purchased low-level support in DoD is an FMS arrangement.

#### Conclusion

The data decisively identifies an increased frequency, in number and value, of direct commercial sales and a decreased frequency of "straight FMS sales". The trend may point to the

U.S. government's responsiveness to the customer country's internal political climate, as was the case with the U.K. AWACS sale or may reflect the customer country's attitude toward the utility of DoD services provided for by FMS surcharges. Nations that feel reasonably confident in dealing effectively with U.S. firms directly have opted to eliminate DoD program management and contracting services and thus avoid 10-15 percent in FMS surcharges. Another possibility is that eliminating FMS surcharges may have been necessary to make a U.S. company competitive in the customer country's selection process.

Investigative Question # 4.

Was there a difference in the contractual vehicles used to execute the sale? Related to the previous investigative question, this question seeks to ascertain the principal contractual documents used in the consummation of the sale. LOAs, of course, are the implementing documents for FMS cases, MOUs are Memoranda of Understanding, and DCCs represent a whole host of Direct Commercial Contracts of which LTAAAs are a subset. As is the previous investigative question, the existence of offset agreements is ignored since it is not relevant to the focus of this question.

Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Contractual Documents</u>
1	Canada	LOA
2	Netherlands	LOA
3	Saudi Arabia	LOA
4	Australia	LOA
5	Egypt	LOA
6	Pakistan	LOA
7	Spain	LOA
8	Israel	LOA/LTAA
9	Turkey	LOA

The primary contractual document used in this half, without exception, was the government-to-government LOA. In addition, Israel conducted its low-level direct commercial contracting activity through the use of LTAAAs.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Contractual Documents</u>
10	Germany	MOU/LOA
11	Greece	DCC
12	United Kingdom	DCC
13	Israel	LOA/DCC/LTAA
14	Egypt	LOA
15	Kuwait	LOA
16	Pakistan	LOA
17	Egypt	MOU/DCC
18	Japan	MOU/LTAA/LOA

While a significant number of LOAs continue to exist, their stronghold was threatened during this period. They were overshadowed by MOUs in a couple of sales and even displaced by DCCs in a couple others. Of special interest is the subordination of the LOA to the MOU in the Patriot sale and the FS-X sale. The MOU between the government of Germany and the U.S. government provided for twenty eight patriots, only half of which were acquired under the accompanying LOA. As discussed earlier, the FS-X LOA only purchased low-level support while the MOU provided the framework for the U.S-Japanese relationship for the entire FS-X program. At the other end of the document spectrum, neither the British Government nor the government of Greece shared government-to-government agreements with the U.S government for their purchases. Instead, they had some form of direct commercial contracts with U.S. contractors. Israel had an LTAA with GE for the acquisition of engines for its F-16s and an LOA with the U.S. government for the acquisition of the F-16 itself.

### Conclusion

Parallel to the conclusion drawn in investigative question # 3, the data reveals the rising frequency of non-LOA documents to implement U.S.-

international arms transactions. Of course, the rising frequency of non-FMS sales would necessarily result in the rising frequency of the use of non-LOA agreements. In addition, the trend may also indicate the rising complexity of arrangements required to accomplish equitable sales and perhaps point to the inadequacy of the LOA executing form, DD Form 1513 (which is somewhat open-ended) for this purpose.

Investigative Question # 5.

Regarding offsets, was there a difference in the frequency of their use? In other words, was there a difference in how many times offsets occurred in each period?

Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Offsets Given ?</u>
1	Canada	Yes
2	Netherlands	Yes
3	Saudi Arabia	No
4	Australia	Yes
5	Egypt	No
6	Pakistan	No
7	Spain	Yes
8	Israel	Yes
9	Turkey	Yes



It appears that offsets accompanied sales in six out of nine cases or two-thirds of the time in the first half of the decade.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Offsets Given?</u>
10	Germany	Yes
11	Greece	Yes
12	United Kingdom	Yes
13	Israel	Yes
14	Egypt	No
15	Kuwait	No
16	Pakistan	No
17	Egypt	Yes
18	Japan	Yes

Six of nine sales during the second half of the decade involved offset commitments as a condition of the sale. Egypt conceded offsets in its 1987 purchase of F-16s but negotiated them into its 1988 purchase of the M1A1 ABRAMS tank.

Incidentally, both sales involved the same contractor, General Dynamics.

Conclusion

The data reveals that offsets accompanied sales equally (two-thirds of the time) during the both halves of the decade. In every instance but one, the U.S. was the "grantor" of offsets. The one

exception, where the U.S was the "grantee" was the FS-X sale to Japan.

Investigative Question # 6.

In those instances where offsets were involved, was there a difference in the level of offsets granted? Percent level of offsets was calculated by dividing the value of the total offset package by the total case value.

Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Percent Offset</u>
1	Canada	100
2	Netherlands	58
3	Saudi Arabia	N/A
4	Australia	31
5	Egypt	N/A
6	Pakistan	N/A
7	Spain	65
8	Israel	32
9	Turkey	100

The first half of the decade witnessed an average level of 64 percent offsets granted, when granted. For those countries that had purchases in both periods, individual trends were tracked in hopes of generating insights that may be useful. To this end, Egypt and Pakistan were identified as having no offsets accompany their F-16 purchases

while Israel was identified as having a 32 percent offset commitment accompany its F-16 purchase.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Percent Offset</u>
10	Germany	42
11	Greece	100
12	United Kingdom	130
13	Israel	40
14	Egypt	N/A
15	Kuwait	N/A
16	Pakistan	N/A
17	Egypt	20
18	Japan	40

The second half of the decade also witnessed an average level of 62 percent offsets granted, when granted. However, the Israeli F-16 offset package climbed up to 40 percent. The Egyptian and Pakistani F-16 purchases, again, were not accompanied by offset commitments. The more recent Egyptian M1A1 tank purchase involved a twenty percent commitment. Paradoxically, the Israeli and Egyptian programs are entirely funded by Security Assistance. It was also noted that the offsets negotiated in the direct commercial sales (to U.K. and Greece) were at least twice as high as the nearest offsets negotiated in any other purchasing arrangement.

### Conclusion

The average level of offsets granted remained relatively constant around 62-64 percent over the entire decade. A subset of the data, recipients of massive Security Assistance, appear to be enjoying a modest increase in offsets in the latter half of the decade. An additional observation noted that over the entire decade the U.S., as grantor, granted an average of 65 percent (after removing FS-X out of the dataset) while it received, as grantee, 40 percent on the FS-X deal. Of course, caution must be exercised when comparing a single point to an average.

### Investigative Question # 7.

Where offsets were granted, was there a difference in the direct offsets to indirect offsets ratio? Since direct and indirect offsets are complementary (i.e. percent direct plus percent indirect equal 100 percent), it was only necessary to calculate one or the other. Direct offsets are presented below as a percentage of total offsets assuming that each total offset package is a whole (or 100 percent).

#### Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Percent Direct Offset</u>
1	Canada	15

2	Netherlands	100
3	Saudi Arabia	N/A
4	Australia	25
5	Egypt	N/A
6	Pakistan	N/A
7	Spain	25
8	Israel	100
9	Turkey	67

Approximately 55 percent of all offsets during this period were pledged to the direct component. Conversely, 45 percent of all offsets were indirect. Explain how Netherlands was calculated.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Percent Direct Offset</u>
10	Germany	100
11	Greece	26
12	United Kingdom	10
13	Israel	57
14	Egypt	N/A
15	Kuwait	N/A
16	Pakistan	N/A
17	Egypt	100
18	Japan	100

On the average, direct offsets accounted for approximately 66 percent of all offsets granted during the second half of the decade. Indirect

offsets, therefore, accounted for 34 percent of all offsets.

### Conclusion

The average direct to indirect offset ratio changed somewhat, from 55:45 in the first half of the decade to 66:34 in the second half.

Closely related to the idea of "quality workshare", most countries negotiating deals during the second half of the decade insisted on and received offset work related directly to the sale of the weapon system. A possible explanation is that as the offset phenomenon matured, countries were better able to target offset resources to their perceived needs. An additional observation yields that the U.S., as grantor, granted an average mix of 57:43 over the entire decade (after eliminating FS-X from the dataset) while it secured a 100:0 mix ,as grantee, on the FS-X deal. Again, a caution is offered against reading too much into the comparison of one datapoint to an average.

### Investigative Question # 8.

In satisfying their offset obligations, were the types of undertakings different? In other words, were the arrangements that governments and companies entered into to satisfy their offsets

requirements different between the two periods?  
Refer to the definitions section for details on  
terms used below to describe types of  
undertakings.

Period Profile 1980-1984

<u>Sale #</u>	<u>Country</u>	<u>Types of Undertakings</u>
1	Canada	Traditional indirect
2	Netherlands	Coprod/Trad. indirect
3	Saudi Arabia	N/A
4	Australia	Coprod/Trad. indirect
5	Egypt	N/A
6	Pakistan	N/A
7	Spain	Coprod/Trad. indirect
8	Israel	Coproduction
9	Turkey	Coprod/Trad. indirect

During this period, offsets were satisfied in traditional ways. Direct offset credits were earned by establishing coproduction facilities in the customer country and indirect offset credits were earned by selling or opening new markets for the customer country's products. Perhaps the most creative arrangements were providing assistance to a Spanish consortium to acquire a Maine power plant or running an internship program for Spanish graduates.

Period Profile 1985-1989

<u>Sale #</u>	<u>Country</u>	<u>Types of Undertakings</u>
10	Germany	Coproduction
11	Greece	Coprod/Venture capital co.
12	U.K.	Non-traditional indirect
13	Israel	Coprod/Trad. indirect
14	Egypt	N/A
15	Kuwait	N/A
16	Pakistan	N/A
17	Egypt	Coproduction
18	Japan	Codevelopment/Coprod

While coproduction continued to dominate this period, other arrangements made a significant presence. For instance, the Greek offset agreement provided for the creation of a profit-seeking venture capital firm to satisfy the 700 million dollar indirect offset commitment through its operations. The company is free to pursue virtually any profit opportunity that benefits Greece. On the other hand, U.K. restricted Boeing's ability to gain credit toward its 120 percent indirect offset commitment to the sale or marketing of British "high-tech" products.

Perhaps, the most significant entry was that of codevelopment. In the FS-X deal, the U.S. negotiated not only "quality" coproduction, but "quality" codevelopment as well.



### Conclusion

The data suggests the use of more creative, albeit sometimes more restrictive, types of arrangements that customer countries and U.S. companies entered into to satisfy their offset obligations during the second half of the decade. The first half was dominated by traditional direct and indirect arrangements.

### Investigative Question # 9.

Was there a difference in the issues that surrounded the sales? The answer to this question defies simple data collection and comparison. While every effort was made to research and accurately reconstruct the deals as they were being considered and debated, the financial costs of extensive research constrained complete reconstruction. Consequently, those sales that received considerable press revealed their major issues readily and at lower cost while those that received less press, required more research resulting in higher costs. In some of the cases that belong to the latter category, only a flavor of the debate was captured with the resources available.

This limitation degrades the answer to this investigative question, however, the answer seems

to point to an important phenomenon that cannot be abandoned on the basis of this limitation. The answer shall have served its purpose if it only sows a seed that germinates future research.

#### Period Profile 1980-1984

During this period, it appeared that the issues focussed primarily on security concerns. A sample of issues yielded concerns ranging from whether granting E-3s to Saudi Arabia would threaten Israel's security to speculation about Egypt's stability after Sadat's assassination to the examination of impacts the Pakistani aid package would have on U.S-Indo relations. While opening new coproduction facilities in Australia, Spain, Israel, and Turkey generated some interest, they were not the subject of high-level national debates.

#### Period Profile 1985-1989

This period witnessed the rise of economic issues to a much higher plateau of interest. Congress began to evaluate, not only the security ramifications of major weapon system sales, but the economic ramifications as well. The unprecedented levels of offsets granted in the British AWACS sale, and subsequently, the French AWACS sale generated heated debate over trade balance issues. The M1A1 ABRAMS sale to Egypt

involving the creation of a coproduction facility in Egypt was scaled back considerably in response to concerns about the impacts of losing U.S. jobs. The FS-X sale helped to bring to center stage, arguments regarding "technology give-away" and regarding the creation of future competitors in addition to arguments regarding the U.S. industrial base and regarding trade balances.

Two administrations (President Reagan's and President Bush's) and Congress agonized over and expended considerable resources to reach compromises on the FS-X which continues to command high visibility almost two years after its inception.

### Conclusion

It appears that there was indeed a difference in the issues that surrounded the sales of the latter half of the decade when compared to the issues that surrounded the sales of the earlier half. While it may be premature to say that economic issues eclipsed security issues, it certainly seems that economic issues rapidly gained ground during the second half of the decade.

### Summary

Results of the thesis are presented below in a sequence corresponding to the investigative question sequence:

Result # 1. The second half of the decade witnessed some diversification in the types of weapon systems sold.

Result # 2. The customer base remained unchanged in that two-thirds of sales in each period were made to third world countries.

Result # 3. The second half evidenced an increase in the incidence of direct commercial sales arrangements.

Result # 4. Consequently, the second half also saw the rise in the use of non-LOA documents to implement sales.

Result # 5. The number of times offsets were granted as condition to the sale remained constant in both periods at two-thirds of all sales.

Result # 6. When offsets were granted, the average level granted remained remarkably constant at 62-64 percent during the entire decade.

Result # 7. When offsets were granted, the direct offsets to indirect offsets ratio changed from 55:45 in the first half to 66:34 in the second half.

Result # 8. Companies and countries entered into more creative arrangements in the second half in order to satisfy their offsets.

Result # 9. Economic ramifications of major

weapon system sales gained marked importance in

the second half of the decade over the first half.

The results indicate that while the administration has strongly advocated military R & D cooperation with allies, major arms transactions have been dominated by production programs. The FS-X stands out as the only cooperative development program that exceeded the threshold of this research.

The results also suggest that the spread of military-related technology through coproduction programs has been a classic example of the "dramatic globalization" of technology witnessed in the last ten years. Furthermore, indirect offsets, whereby U.S. contractors have either sold foreign goods or opened new markets to them, have doubtlessly, aggravated in a small way, the mounting U.S. trade deficit of the eighties (as discussed in the literature review). However, the declining trend of indirect offsets in the last half of the decade diminishes the arms sales related component of that effect somewhat.

Finally, the rise of economic issues is acknowledged by even high-level DoD officials. For instance, the concluding quote in the introduction section of the first chapter cited the Deputy Undersecretary of Defense for International Programs urging people to look at the "economics of cooperation" closer. As economic issues come to gain importance, they provide the forum where ramifications of

DoD decisions on U.S. competitiveness are debated and ultimately decided. Thus, they may foster crosstalk between executive agencies and narrow the interagency gap that the Presidential Commission on Industrial Competitiveness suggested was hampering the nation's ability to compete effectively.

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